The Northwestern MILLER

MILLING PRODUCTION SECTION

The New Correspondence Course of the Association of Operative Millers

More than 40 of the Best Qualified Men in the Flour Milling Industry Collaborate in a Completely New Home Study Service for Operatives

FORMAL presentation of its recently completed Correspondence Course in Flour Milling by the Association of Operative Millers at its 55th annual meeting in Chicago next week will mark the end of a task started more than four years ago by the then newly created education committee of the association.

The operative millers' association became actively engaged in the field of education April 1, 1947, when The Northwestern Miller and the William Hood Dunwoody Industrial Institute transferred the Correspondence Course in Practical Milling to the AOM, during the tenure of office of R. R. Brotherton, general superintendent of the Bay State Milling Co., Winona, Minn., and who was then president of the association.

The original correspondence course in practical milling, as it was offered by The Northwestern Miller and the Dunwoody Institute, was the work of one man—the late Edgar S. Miller, who wrote it while he was a member of The Northwestern Miller's editorial staff. Mr. Miller, who had been for many years an operative miller before he joined the editorial staff of The Northwestern Miller, recognized the need of a correspondence course to fill the gap in the knowledge of millers who could not avail themselves of the opportunity to attend the milling school at Kansas State College, Manhattan, Kansas, but who realized that their skill as millers would be enhanced by instruction in the fundamental sciences forming a basis for milling technology.

That need for some form of training for millers was clearly demonstrated in Kansas City early in the 1930's by a group of men connected with the milling industry in that city. Those men, headed by the late S. H. (Van) Stoltzfuss, established a night school for millers at which informal lectures were given by specialists in their own fields. These night schools enjoyed a good attendance by younger men employed in the Kansas City mills, and much good came of the venture.

The night school was abandoned, however, for a number of reasons which included the lack of an organized sponsorship, the press of other duties on the time of the men who started it, and the limited number of students available to warrant its being conducted on a continuing basis.

But the night school, in addition to adding to the fundamental knowledge of its students, did establish one fact in the minds of a large number of persons: It demonstrated the need of some sort of an educational program which could give more to millers than they could obtain on their day-in and day-out work by simple observation. That job training supplied those millers with the "how" but it did not answer the "why" question which loomed large in their minds.

First Correspondence Course

The editors of The Northwestern Miller recognized that need and shortly after the late Mr. Miller joined its editorial staff, he was assigned the task of preparing a correspondence course in flour milling.

Officials of the Dunwoody Industrial Institute readily agreed to cosponsor the correspondence course. The institute, established under the terms of a will left by Mr. Dunwoody, is primarily a vocational training school. By the terms of the will left by Mr. Dunwoody, the trustees were instructed to offer training in the manual arts and sciences, including that of flour milling. Mr. Dunwoody's legacy was accumulated from his connection with the milling industry. He was one of the principals in the Washburn-Crosby company, predecessor of General Mills, Inc.

But the cost of building and equipping and staffing a flour mill in Minneapolis to enable the institute to offer a resident vocational training course in flour milling was prohibitive, the trustees of the institute concluded. Not many millers, they found, could afford the expense of quitting their jobs, come to Minneapolis and live while they were enrolled in the course. The net result would be an expensive milling plant and few students which would put the plant investment per student at a very high level.

Dunwoody Institute Cooperates

Since the students could not afford to come to Minneapolis to study flour milling technology, the next best thing was to take the education to the students. Officials of the Dunwoody Institute agreed with the editors of The Northwestern Miller that a correspondence course in milling would be of inestimable service to the flour milling industry. So, the course would be prepared under the sponsorship of the business journal as a service to its industry, with administration of the course to be supervised by the staff of the Dunwoody Institute.

Mr. Miller, in preparing The Northwestern Miller-Dunwoody Institute course, set it up to consist of four units of 12 lessons each, or 48 lessons in the complete course. It was first offered in 1938, and, needless to say, it met with ready acceptance and approval by the flour milling industry.

A fee of $15 for each unit, or $60 for the complete course, was agreed upon by its sponsors. The Northwestern Miller produced the lesson pamphlets in its own printing production department, setting the type and having the necessary engravings, halftone plates and zinc etchings made. Obviously, the journal invested much more in the course—from a dollars-and-cents analysis, than it ever received, but it was never intended that the correspondence course be regarded as a "profitable sideline," but as one of the journal's contributions to the industry that it serves.

The success of the venture into the educational field by the two sponsoring organizations prompted an occasional suggestion by members of the Association of Operative Millers from time to time that the AOM should undertake production and distribution of a similar course to its members. A large part of the enrollment of The Northwestern Miller-Dunwoody course came from members of the millers' organization, but nothing was ever done about it, largely because of the tremendous amount of work and the expense involved.

The World War II years, of course, reduced the enrollment in the correspondence course just as it reduced the enrollment in the nation's colleges and universities. Shortly after the close of the war, when the soldiers-millers returned to their jobs in the nation's flour mills, enrollment in the correspondence course returned to its prewar level and, following publication of some pamphlets and advertising, enrollment was increased to approximately 125 students, where it stood when the course was transferred from Northwestern Miller-Dunwoody sponsorship to that of the Association of Operative Millers.

During the war years the Millers National Federation, through its postwar planning committee, recognized the effect of war manpower mobilization on the ranks of the operative millers. The committee, headed by Harry S. Bullis, then president of General Mills, Inc., urged the formation of a technical service department of the federation, and specified that the department should give immediate attention to the expansion of training facilities for operative millers. Roy K. Durham, who at that time was general superintendent for the Rodney Milling Co., Kansas City, was employed by the federation to head up its technical service department. Mr. Durham acted as the representative of the Millers National Federation in all discussions having to do with expansion of training programs.

Course Offered to AOM

It was during this same period that The Northwestern Miller and the Dunwoody Industrial Institute approached the Association of Operative Millers, offering to donate the correspondence course to the technical organization.

In commenting editorially upon the transfer of the course to the AOM, The Northwestern Miller said, in part:

(Continued on page 12a)

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Milling's Golden Era

Operation of the Universal Bolter

By W. D. Gray

EDITOR'S NOTE: The accompanying article is the 18th in a series being published under the heading, "The Golden Era of Milling." This and the preceding articles in the series were published originally in The Northwestern Miller more than 50 years ago and were written by W. D. Gray, a leading flour mill engineer at that time. Mr. Gray, in this article, concludes his discussion of the development of the Universal Bolter, one of his many inventions.

HAVING fully described in detail the construction of the Universal bolter in the previous article, I will try to describe its operation, and, in order to make matters plain and fully understood, it will be necessary to make comparisons between this machine and machines of other makes, but I have no intention of trying to harm in the least any other machine. If I should, the little good that this article may do to some will have to be taken as an offset for whatever harm may be done in other directions; but to be fair to the reader, it must be understood that in talking about the Universal bolter, I am like a mother talking about her own baby as compared with some other baby. Or, if it were a case at law, and I were the judge, the other fellow would probably want a change of venue and it should be granted, so that you may, if you please, take it for granted that I am prejudiced in favor of the Universal bolter.

Why is it that the Universal bolter is round and all other sieve bolters are oblong or square? In the first place, I believe that the outer parts of the sieve should be an equal distance from the driving shaft, so that the load is equally distributed around the center, making the machine easier to balance and getting a more uniform movement on the stock. For instance, if a machine is twice as long as it is wide and you get more of a load on one end than on the other, as is usually the case, I do not believe it possible to get a perfect balance.

Better Load Distribution

In other words, if the machine is square, it can be balanced more easily; or if round it can be still easier balanced, because the load is even on all sides and at the same distance from the driving shaft, and this is quite important on a sieve bolter. Then, to get capacity on the Universal bolter it is built higher than any of the other sieve bolters, but it occupies less floor space than any other, the largest size, 70-inch machine, only occupying about seven feet square, and they are not so high but that they can stand on any mill floor and have plenty of space over them. The rectangular machines take about double the floor space and the room over them cannot be used for any other purpose. The Universal bolter occupies less space and contains more silk surface than any other, which is equivalent to larger capacity.

This machine is higher, and if the construction were the same as the others, it would be harder to balance according to its height; but the others (and when I say the others, I mean all sieve bolters having a rectangular sieve box) are driven from below, having their eccentric or wrist-pin and balance-wheel below the sieve-box, while the Universal bolter has a heavy shaft passing up through the center of the machine with a balance-wheel at top and bottom just outside of the eccentric-boxes, leaving the load between the two balance-wheels. Now, I claim these conditions are about scientifically correct, the strains are easy and well distributed and it can easily be put in perfect balance.

Again, to compare with other types of machines, they are not only too long for their width, but they are also too high. As they are now constructed the load overhangs the eccentric pin and the balance-wheel. If the wheel were to be placed in the center of the box and the point of suspension lower, in theory it would be almost correct, but in practice it would be better and much more satisfactory to have the shaft run through the machine with wheel above and below, as in the Universal bolter. This point is part of and one of the valuable features peculiar to this machine. I think if anyone will study the theory and then go and examine both types of machines, he will come to the same conclusion.

Better Flow of Stock

Another valuable feature of this machine is the flow of the stock on the sieves. Some that do not understand the machine, but are looking for some fault to find, will tell you that the stock that travels around the inner drum will not be as well bolted as that which travels around the outside of the sieve. If the stock traveled thus, then this theory would be a good one; but if the first stock that struck the sieve started to travel around the inside of the drum, how would stock get to the outside? The facts are (and anyone can find out by an investigation) that the stock when it strikes the sieve travels in two directions, viz., around the sieve and toward the periphery, so that the load is always even on the sieve. No stock that starts around at the drum is there when it comes to the discharge, but it may have traveled from center to circumference several times in its journey to the point of discharge.

The stock travels reasonably fast. There is the gentle hand-sieve motion that brings the impurities to the top, leaving the clean stock always next to the cloth, so that if desired coarse cloth can be used and still have clean stock. There are no flights or paddles of any kind in these sieves to mix up or turn over the stock, the importance of which can hardly be estimated, for every practical miller knows that all dust flour made from abrasion is of poor quality; and this is one

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of the main reasons why we wanted to get away from the reel and conveyors.

Differs From Reel Action

The action of a reel, no matter how well constructed, is a tumbling, rolling action, and then when the reel gets through with it, the stock is tumbled into conveyors. Now as we are trying to get away from this, let us not countenance harsh conveyors in our sieve bolters. By way of comparison, one of these Universal bolters will take the stock of from 6 to 12 reels, according to the size of the machine and the kind of stock to be treated, and if it be a break it will scalp the break, grade and dust all the middlings and finish the flour without ever touching a conveyor, and the work will be better done than it is possible to do with any system of reels. If this be so, then surely the days of the reel are numbered.

As a milling engineer, and anxious to know what others thought of sieve bolters, I wrote a letter to an old friend and first-class mechanic who had just built and started a mill using the Universal bolter system. It was the first Universal bolter he had ever seen. Having confidence in his unbiased opinion, I asked him for it, and I herewith quote from his letter:

"You want to hear just what I think. As you are aware, I have never had any experience with any of this class of machines before, but outside of this class I think I have had as much as most men, and I have been a close observer. I have seen many promising infant bolters born, some of them, I regret to say, might have had their paternity brought home to me had anyone been disposed to do it. These machines have promised well and for a time showed evidence of merit, but one and all have gradually perished, until I have grown skeptical as to whether any material progress has been made in bolters in my time. But this machine appears to me to have merit.

"There is in it the true principle of bolting as it has always appeared to me, and that is, have all the cloth bolting all the time, and do it without mechanical forces or contrivances that are unproductive and liable to wear and derangement. I am unable to see how this could be better accomplished than it is in your machine, and it would therefore seem that, having the true principle, the machine ought to be a 'stayer,' for it certainly does good work, is not hard to run, does not appear to be liable to wear out or get out of order, and above all, it cannot be 'monkeyed' with. No fool miller can pull slides and make bad worse by running improperly finished stock away to derange something else. He must do his milling at the rolls, where it should be done.

"I have long been convinced that bolters with cut-offs were the curse of the trade, but failed to impress my views to any extent upon others, and every time I go past one of your machines I take off my hat to it, for it has done what I never could do; it has done away with the cut-off fallacy, and that alone, in my opinion, is well worth the price of a bolter for any mill-owner to learn. Since the advent of the sieve bolters I have been away from the milling world and have seen practically nothing of them. But from what I have seen of the working of these machines, and from what I know of the efficacy of the movement in other lines, I am free to say that I think it the only real advance in the science of bolting that has been made in the quarter of a century that I have had to do with such things. If you could devise some sort of an automatic balance whereby the machine would adjust itself to varying loads it would be a desirable thing, provided it be effective and not 'trappy,' but aside from this I do not see how it could be better than it is; not that it is at all difficult to balance now, but it needs a little patience, a little judgment and skill —common things but not always available."

Cleaning Bolter Cloth

The cleaning of the cloth on any sieve machine is important, and it has been no easy problem to solve. A great many things have been tried. Some of them use grain or seeds returning back over the sieve. This is trying to clean the cloth from the top. Some are using loose chains dragging with the stock on top of the sieve. This is an old and abandoned method used on purifiers in the West 20 years ago. It was also the first cleaner that we tried on the Universal bolter, but as it did not do well, we soon abandoned it. We found it hard on the cloth and also on the chain, and cleaned the silk in spots. I have found the little brush, as illustrated in this article, the most effective, and

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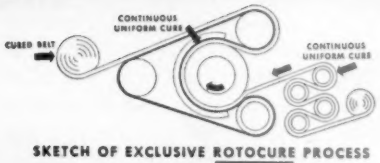

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no matter what is used, I believe the proper place to clean the cloth is from below.

Miller's Skill Still Needed

The construction of any machine having this motion is no easy matter, for they must be made strong; for a flour mill, unlike most other factories, must run night and day from Sunday to Sunday; any shutdown in the middle of the week is expensive. As the Universal bolter is now built, there is no more reason for shutting down than with a reel mill, with reasonable intelligence to run the mill. This does not mean that you can take a man off the street, as some owners of small mills seem to think, and run the mill. Because the machine cannot talk and will refuse to be abused, such mill owners will shut down and ask the builder what he is going to do about it. The answer should be, "Nothing. Go and get a good miller." I know that all manufacturers of sieve machines have this to contend with, but it is not much worse than it was when rolls were introduced, and it calls for a little better class of men to run small mills.

The machine of the round type is capable of being made fully as strong and substantial as the others, for the reason that it is more compact and nearer the driving shaft. The Universal bolter is now just twice as heavy as it was when the first machine was built. This will give an idea of its development.

In the development of this machine there have been many experiments made. The machine was built square and fully tested and found not to be as good as the round. The manufacturer, however, wishing to produce only the best, abandoned it for the present form of the Universal bolter.

All of the valuable features of this machine, as well as in the experiments, are covered by patents already issued, and applications now in the patent office are pending, and are controlled by the Edward P. Allis Co.

I trust that I have made the construction of this machine plain and that the reader will fully understand the action of the stock. If I have done this I have done my duty and left you at liberty to buy either type of the sieve bolter; yet no doubt some men may still think that the old reels are good enough for them.

—BREAD IS THE STAFF OF LIFE—

CONTRACT LET FOR NEW GENERAL MILLS SOY PLANT

PITTSBURGH — The chemical plants division of Blaw-Knox Co. has received an order from General Mills, Inc., for engineering and construction of a 250-ton per day soybean processing plant to be located at Rossford, Ohio.

Equipment to be furnished by chemical plants division includes machinery and process equipment for conditioning, cracking and flaking the beans; the Blaw-Knox Rotocel for extracting the oil; solvent recovery system, and grinding, storage and loading of the finished product.

—BREAD IS THE STAFF OF LIFE—

V-BELT DRIVE CAPACITY

A V-belt drive should be designed so that, in case of a stoppage of the driven machine, the belt should be able to completely stall the motor. The motor should be equipped with an overload relay, so that the current will be turned off a short time after it stalls. A V-belt, unlike a flat belt, cannot jump the pulley and if the driven machine stops the friction of the motor pulley will ignite the V-belt if the motor continues to run.

Transport of Fluidized Solids

By John M. MacKenzie

EMPHASIS on mill sanitation and a constant tightening of sanitation standards have centered attention on improvements in the traditional methods of handling granulated food products. Various forms of pneumatic conveying have been given careful consideration because of ease of sanitary control and economy of space. The most common form of pneumatic system requires air velocities of 50 to 100 ft. per second in order to convey materials in the ratio of 5 lb. of solid for each pound of air (1,3, and 13).* The horsepower requirements and consequently the operating costs are excessively high when compared with older types of mechanical handling equipment. In order to justify the pneumatic system it is necessary to consider the sanitary and dust control advantages as compared with the less expensive mechanical methods.

Designers of pneumatic systems have been steadily increasing the concentration of solids per unit of air and at the same time trying to find methods of reducing the air velocity required to maintain the solids in suspension. In long horizontal ducts,

*Numbers in parentheses refer to Literature Cited.

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the higher the solids concentration, the greater the velocities of both air and solids required to maintain the suspension of solids in air. Ratios of solids to air in present pneumatic systems, can be as high as 10 to 1 by weight, yet the horsepower requirements are higher than for equivalent mechanical handling systems.

Since 1942, however, an increasing number of investigators have shown that a mass of finely divided solids can be made to flow like a liquid. This physical state is commonly described by the word "fluidized." Liquids or gases flowing through a bed of the particulate material are used to produce the fluidized state which involves both the solids and the fluid filling the interstices between the particles. The use of the word "fluid" in this discussion implies the liquid or gas whose flow is used to fluidize the finely divided solid.

Fluidized materials can be conveyed in ducts at concentrations of solids to air as high as 200 to 1 by weight and at velocities as low as 5 ft. per second. A 50% reduction in power is claimed for a system handling pulverized coal in the fluidized state as compared with conventional systems using solids to air ratios of approximately 5 to 1. An additional advantage is the possible elimination of expensive dust separators at the terminal point of the system (1). For many years materials having suitable size ranges have been fluidized and conveyed several thousand feet in commercially operated system (13). The design of these systems has been empirical and the data involved remain unpublished.

In developing practical systems for the transport of fluidized solids, the first problem is the determination of conditions for proper fluidization and secondly how much energy is required to move the fluidized solid through the duct system. The solution can be achieved either on full scale apparatus or by analogy from laboratory appparatus. A number of investigators have chosen to measure the pressure drop under laboratory conditions, derive suitable friction factors, and then apply these to the design of the full scale system.

EDITOR'S NOTE: The accompanying article, reprinted from a recent issue of Cereal Chemistry, was prepared by the head of the flour mill engineering course, offered by the department of mechanical engineering, University of Minnesota. The article is a review of a review of published literature.

Experience with fluid-like behavior of finely divided solids is as old as man's first disaster in quicksand. Scientific investigation of fluid-solid systems in which a rising stream of fluid supports a particulate mass of greater density is comparatively recent. Wilhelm and Kwauk (14) mention studies conducted in the fields of mining and civil engineering and Sadler (13) states that for many years cement and other mineral products have been successfully fluidized. Until the large scale application of finely powdered catalysts, however, very little was published on the dynamics of fluid-solid systems. Success with fluidized catalysts in the petroleum industry centered attention on the use of fluidized solids for large scale processes involving chemical treatment and heat transfer (11). Interest in the fluidized state as a means of transporting finely divided solids through ducts has been secondary to the catalytic and heat transfer properties of a fluid-solid system.

A detailed definition of the fluidized state must describe the stages of fluidization. When a stream of fluid is passed upward through a mass of solid particles, reproducible changes in physical behavior are observed with increasing fluid velocity (5). At low velocities the stream of fluid does not support the solid and the mass of particles is called a fixed bed. With increasing velocity, the pressure drop through the bed rises until it reaches the net effective weight of the solid. At this equilibrium velocity the packing arrangement of the particles becomes more open. Slight increases above this velocity cause the bed to be fully fluidized and supported so that the fluid-solid mixture exhibits the mobility and hydrostatic pressure characteristics of a fluid.

In gas-solid systems, a portion of the gas may accumulate in bubbles passing through the fluidized bed as in aggregative fluidization. Normally the bubbles remain small and the mass becomes a turbulent fluidized bed.

If the fluid velocity is further increased, the surface of the fluidized bed disappears and the whole mass becomes a dispersed suspension. The parameters of the fluidized state for both batch and continuous fluidization have been defined mathematically and correlated experimentally (8, 9, 11 and 14). Fluidization for transport of solids is primarily concerned with continuous fluidization (13).

Lewis, et al. (9) showed that in continuous fluidization there are certain critical values of solid concentration and superficial air velocity corresponding to a given rate of flow

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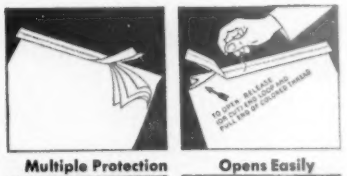

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of the solid feed within which steady operation was maintained. Albright, et al. (1) designed and tested a continuous feeder for finely divided solids utilizing fluidized flow. Correlations between solids-air ratios and volume flow of fluidizing air to the chamber are reported. Deviations from predicted data with small particle size, varying particle size distribution, particle density and particle shape make the application of these data to the fluidization of other materials impractical. However, the experimental procedures and mathematical analysis can be used as a basis for the development of similar data on flour or other cereal products.

The economic success of a system for the transport of fluidized solids depends on the energy required to move the air-solids mass. Studies of pressure drop in fluidized flow have been concentrated on vertical flow, the most common in catalytic reactions (2, 6). Studies of combined vertical and horizontal flow are compared by Farbar (4) and studies of horizontal flow only are reported by Albright, et al. (1). Martinelli, et al. (1) presents a mathematical analysis of two-phase flow for horizontal systems operating under either viscous or turbulent flow.

Belden and Kassel (2) express the total pressure drop in vertical flow as the sum of static and friction terms where the static head is dependent upon true particle density and concentration of solids in the duct. The friction term is expressed as a generalization of the Fanning equation (2) and correlated with the mass term for the gas-solid system. Deviations from the correlation are noted at velocities below the point of minimum pressure drop and at low ratios of tube diameter to particle size.

Hariu and Molstad (6) present a mathematical analysis of total pressure drop as the sum of static, solids friction and gas friction terms. A basic equation is developed for the total solids pressure drop, but calculations of the Fanning friction factor from the experimental data reveal variations due to the acceleration of solids. As a result of this observation the authors restate the basic equation differentially to include the pressure drop required to accelerate the particles. Test procedures and sample calculations are described in detail and the calculation of a practical application is presented.

Comparing horizontal with vertical transport, Farbar (4) comments on the predominance of the solids friction factor in the pressure drop in horizontal flow. Although Chatley (3) is primarily concerned with dilute concentrations of solid in air, his comments on the predominance of solids acceleration and the velocity required to maintain the solids in suspension as the major factors in energy requirements for horizontal two-phase flow are of particular interest in the light of Farbar's observations.

Albright, et al. (1) using solid-gas concentrations as high as 200 to 1 by weight, report no difficulty with phase separation in the duct and in addition describes dust free delivery of solids at the terminal end of the duct without use of dust separators. The general energy equation is used to derive an expression for pressure drop which permits correlation between the friction factor and the mass velocity of the solid. Maintenance of flow at velocities as low as 2 ft. per second are mentioned which more than compensated for the increase of solids friction as compared with less concentrated solids-gas mixtures.

This brief survey of the literature on the transport of fluidized solids reveals that the mathematical analysis of parameters, methods of correlation and experimental procedure have been developed for application to a wide range of materials and conditions. However, the transport of fluidized flour or cereal products requires extensive experimentation to determine optimum conditions for fluidization and the factors contributing to total pressure drop.

Acknowledgment

The literature survey has been developed from a bibliography with abstracts prepared by Wickliffe B. Hendry for the milling engineering curriculum at the University of Minnesota (7).

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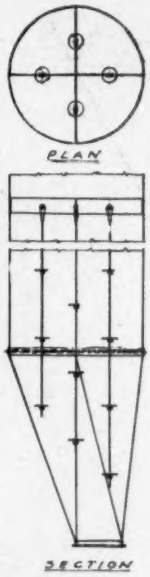
—BREAD IS THE STAFF OF LIFE—

40 SOLDIERS INSPECT COLLEGE MILL, BAKERY

MANHATTAN, KANSAS — Forty soldiers from nearby Ft. Riley visited the department of milling industry at Kansas State College recently.

The soldiers recently completed cooks' school in the Quartermaster Corps. The tour was an army class field trip.

Before touring the mill they were given a short lecture on milling by Prof. John A. Johnson, and Eugene P. Farrell, milling technologist.



"FLYING SAUCERS" — The Day Company, Minneapolis, manufacturer of steel flour and millfeed storage bins, has devised an anti-bridging device for bran bins which millers were quick to name "flying saucers." Shown in the above sketch are plan and section details of the device which consists of circular discs secured to steel cables which are suspended from a framework within the bin. The circular discs support much of the weight of the bran in the bin, relieving the walls of the hopper and thus permit the bran to be discharged continuously from the feeder. The diameter and height of the bin determine the dimensions of the discs and supporting cables and framework.

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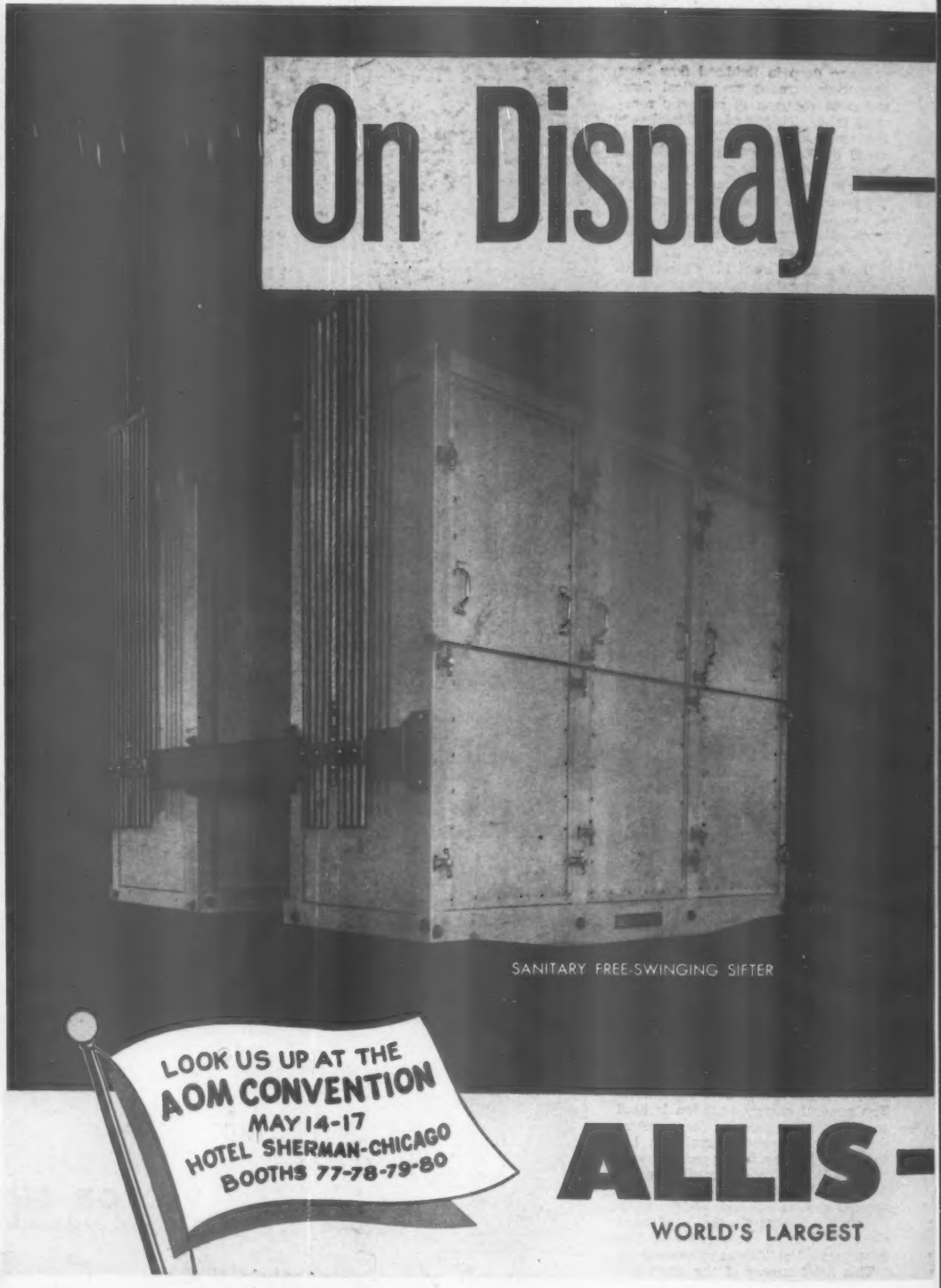
Improving the Uniformity of Buhler Experimental Milling

By E. F. Seeborg and M. A. Barmore

Techniques and modifications for improving the reliability of results in milling small samples of grain on the Buhler laboratory model mill are suggested. These procedures have been developed during the past two years at the Western Wheat Quality Laboratory, Pullman, Wash. Some of the ideas presented are believed to be original, but others are borrowed directly from other research workers or are improvements on present practices.

Mechanical Changes on Feeding Control

Two minor mechanical changes aid in insuring a more uniform rate of feed from the hopper to the first break. One of these is to tap the feeder roll at the bottom of the hopper for a 3/16-in. screw, the hole being located so that it passes the opening for the wheat as near to the edge of the closed position as possible. The head of the screw is removed and only enough of the shaft left to clear the opening. It is necessary in making this change to cut a small hole in the back side of the hopper for the screw to pass through as it revolves. A piece of sheet rubber with a slit over the hole is cemented in place to prevent wheat from dribbling through. With this kicker on



the feed roll, it is possible to maintain a uniform rate of feed at any level desired.

The second mechanical change is to recalibrate the slide index showing the opening of the feed gate and to add an additional pointer for closer observation. This pointer is constructed of metal and is attached to the shaft controlling the feed gate with a bolt. The pointer follows the shaft to the side of the mill and then is bent 90°, about ⅜-in. extending parallel to the side of the mill. The old markings are filed from the slide index, and new calibrations are made. The zero position is marked on both the slide and on the side of the mill, with the gate in a closed position. Each successive mark on the slide represents a 360° turn of the knob, as indicated by the pointer on the side of the mill. The circle circumscribed by this pointer can be subdivided into degrees or into decimals if closer readings are required.

Mixing of Middlings Stocks

A variable amount of mixing of the stocks coming from the reduction rolls to the sifters is caused by the action of the chains on the scalps. This can be prevented by cementing plastic or cardboard strips to the sides of the frames and to the metal divider between the second and third sections. The strips are 1 in. wide and extend nearly the full length of the scalp frames.

Wire Sizes on Scalps

The heterogeneous nature of the middlings stock going to the first reduction rolls has been one of the faults of the Buhler automatic mill. This results from the use of coarse scalping screens on the breaks, varying from No. 26 wire on the first to No. 38 wire on the third break.

After numerous trials, it was found that this condition could be corrected by the use of finer scalp wires, that is, No. 44 wire for the first two breaks and No. 64 wire for the third break scalp. Improved results were also obtained with No. 48 wire scalps at the head of the mill and No. 64 on on the third break. Since approximately 95% of the flour middlings are obtained from the first two breaks by the use of rather severe breaking action, it is possible to use a No. 64 wire on the third break scalp without lowering the yield of flour.

The advantage of such a fine scalp is the separation of the bran dust and shorts earlier in the milling operation, with a resultant lower contamination of the middlings stock. The more uniform particle size of the middlings stock, due to the use of similar scalps on the first and second breaks, results in a significant improvement in the reduction operations of the mill.

Closer grinding on the first reduction is possible without the usual "pancaking" of middlings. A larger percentage of flour bolts out on the first reduction, with a subsequent improvement in the balance of the mill and the final cleanup. Finally, the smooth rolls run at a lower temperature, even with closer roll settings, with an improved agreement in results between duplicate samples. The improved bolting action is accomplished without increasing the ash content of the patent flour. The clears, on the other hand, are significantly higher in ash but compare favorably with clears obtained from commercial mills. A suitable selection of streams to make various patents is possible since there is a marked difference in their ash content. With soft wheats, a good short patent containing about 70% of the total flour, having an ash content of .32% to .36%, can be made from the first and second breaks and the first middlings flour streams. By rebolting

EDITOR'S NOTE: Mr. Seeborg is a junior chemist, and Dr. Barmore is senior chemist on the staff of the Western Wheat Quality Laboratory at the Washington Agricultural Experiment Station, Pullman, Wash. The laboratory is a regional laboratory of the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U.S. Department of Agriculture. The following article appeared originally in the Transactions of the American Association of Cereal Chemists.

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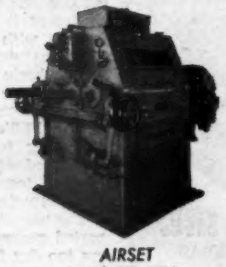

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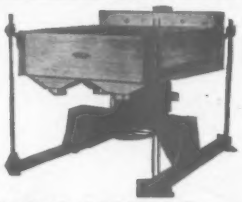

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these streams over silks finer than 10XX or by clothing the mill with finer silk on the low ash patent streams, it is possible to duplicate commercially milled specialty flours.

Roll Temperatures

An unknown, but probably important, significant, variable enters into the experimental milling of small samples of wheat, due to the gradual rise in grinding roll temperatures. This rise continues for several hours, after which no further increase occurs. This temperature increase may vary with each mill and with its operation. At the Western Wheat Quality Laboratory at Pullman, Wash., where the grinding room temperature is held constant at 70° F. during the day and drops to 68° at night, the roll temperature of the mill rises gradually from 68° to 92° in about 3 to 4 hours and then remains approximately constant.

To eliminate this change in roll temperature, it was found that one 40-watt showcase-type light bulb placed under each set of rolls assisted in keeping them at a uniform temperature all night. One "warmup" sample at the start of the day's milling usually increases the roll temperature to the maximum. Thereafter, all samples are ground at the same temperature.

Tempering of Wheat

For the best results with the short grinding system of the Buhler laboratory mill, it is necessary to mellow the endosperm more thoroughly than for milling by a longer system. If the moisture content of the wheat to be milled is relatively low and needs to be raised 4 to 6% or more for proper milling, a longer tempering period is necessary to enable all parts of the endosperm to reach a moisture equilibrium than if less moisture adjustment is needed. Our experience agrees with that of several others that, at normal temperatures and atmospheric pressures, 72 hours is required for uniform initial tempering. Dr. Betty Sullivan of the Russell-Miller Milling Co. has shown that this long tempering period can be shortened effectively by the use of surface tension reducing agents in the tempering water.

The use of a long initial tempering period generally leaves the bran layers too dry for close grinding on the breaks, except when moistures above 15% are used on the wheat. The addition of .75% moisture 30 to 40 minutes before milling is sufficient to toughen the bran.

Roll Settings

The settings of the break rolls on the Buhler mill need to be considerably closer than those recommended by the manufacturers to secure flour yields comparable with those obtained by commercial mills. Both a higher initial break release and more break flour than would be obtained on a conventional five-break, eight-reduction system are required for equally high flour yields. Also, the larger middlings must be reduced on the second break rolls by appropriate scalping on the first break sifter before being sent to the smooth rolls. H. W. Baker and N. L. Gregory, working with hard wheats, obtained significant correlations between Buhler and commercial milling by setting the first break rolls with a clearance of .47 mm. and the third break rolls with a clearance of .036 mm.

Results with soft wheats in this laboratory lead to a similar conclusion. The settings of the first reduction section need to be very close for hard wheats to get a good yield of patent flour. Roll spacings of .04 mm. have given satisfactory results. For soft wheat middlings, good reduction is obtained by a setting of .06 mm. The third reduction should be adjusted as close as possible to clean up the shorts. This setting will vary from .02 mm. to .005 mm. depending upon the nature of the middlings stock.

Sieve Cleaners

The action of the chain sieve cleaners changes significantly with different amounts of slack in the chain. An optimum whip action is obtained when the chains are just loose enough to give each chain a short throw. The efficiency of the bolting depends to a large extent on the cleaning action of these chains, which should be adjusted uniformly to the same throw.

Rate of Feed

The average normal rate of feed is increased from 100 g. a minute to about 130 g. a minute by the adjustments and changes discussed. This increased load improves the quality of the flour obtained on the breaks without sacrificing cleanup or yield. The rate of feed is increased if the quantity of material at the end of the system is less than usual, and decreased when flour tails over into the shorts. It is important to keep as high a rate of feed as possible if a low ash flour is desired.

Results

Average straight grade flour yield and ash results from a series of composite samples of each of 16 varieties in the 1949 Uniform Winter Wheat Yield Nursery in the Pacific Northwest region are 74.4% and .42%, respectively, with ranges of 71.5% to 77.8% and .35% to .45%. The average protein of the wheat was 8.4% and on the flour 7.2%.

Separation of the flour into patent and clears yielded a patent averaging 91.5% of the total flour and .39% ash, the 8.5% clears averaging .79% ash. A range of 88.7% to 94.4% in length of patent obtained from the first two break and the first two reduction streams was found. This series of samples consisted of five soft white winters, six western white winters (club type), three hard red winters, one soft red winter and one hard white winter wheat. The average test weight was 60.4 lb. a bushel and the average wheat ash was 1.41%. The average rate of feed on these millings was 127.6 g. a minute.

The following silk and scalp sizes are suggested for grinding soft wheats when either a long patent or a straight grade flour is desired: 10XX silks for all breaks and reductions. 44W for 1st and 2nd break scalp, with 64W for 3rd break scalp. 54W for 1st reduction scalp and 64W for 2nd reduction scalp.

Acknowledgments

The authors are indebted to Mr. Reuben Waitman, Igleheart Bros. division of General Foods Co., Evansville, Ind., for the suggestion of the feeder roll kicker, and to R. J. Butler, formerly of the Western Wheat Quality Laboratory, Pullman (and now with the Capitol Milling Co., Los Angeles, Cal.), for the particle size analyses.

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Correspondence Course

(Continued from page 1a)

"The Dunwoody-Northwestern Miller Correspondence Course in Practical Milling is being turned over—lock, stock and barrel—to the Association of Operative Millers. This is a consummation long desired by the publishers of The Northwestern Miller and doubtless long hoped for by leaders of the flour milling fraternity who have felt that such an activity not only was essential to the best interests of the industry but was an obvious responsibility of either the management or the operative association of millers—or both.

"The correspondence course was begun 10 years ago as a joint service to the flour milling industry by The Northwestern Miller and Dunwoody Industrial Institute in Minneapolis, and has been conducted on a nonprofit basis. It has, in fact, entailed a great deal of unremunerated effort and expense on the part of the sponsors and their staffs. So far as The Northwestern Miller is concerned, this was both an opportunity and a pleasure. . . .

"In stepping aside from a field which it entered 10 years ago only because it saw an urgent need and observed with regret that the industry itself did not then see and accept the responsibility for meeting it, The Northwestern Miller has no desire or intention to depart from or to abate its traditional role of service to the milling industry. It has found plenty of ways to lend a hand in the past, and will find others today and tomorrow."

The complete course was accepted on behalf of the Association of Operative Millers by R. R. Brotherton, its president. Plans were made to establish an educational committee within the AOM, and shortly after his elevation to the presidency of the organization a month following transfer of the course, Dewey Robbins, Fisher Flouring Mills Co., Seattle, Wash., named the following association members to the original group:

C. R. Veeck, Eagle Roller Mill Co., New Ulm, Minn., chairman; C. O. Spencer, General Mills, Inc., Buffalo, N.Y.; Warren F. Keller, Kansas State College, Manhattan; J. E. Anderson, Igleheart Bros., Inc., Evansville, Ind., and Philip W. Pillsbury, president of Pillsbury Mills, Inc., Minneapolis.

Membership on the committee underwent slight change during the past four years. Prof E. P. Farrell succeeded Mr. Keller as a representative of Kansas State College; Mr. Anderson resigned from the committee after the first year; and the committee lost the services of Mr. Spencer through death.

Upon his election to the vice presidency of the AOM, Mr. Veeck resigned as chairman of the committee and Mr. Robbins was named chairman in his place.

Education Committee Gets Job

The education committee was assigned the responsibility of determining the policies to be followed in administering the course, the content and the task of "bringing it up to date." The AOM executive committee has been the determining body regarding the fee to be charged and has also made the decisions regarding group plan participation, etc.

The first action of the education committee was to review the original course as a preliminary to undertaking its revision.

"The committee recognized the excellence of the course, and also recognized the need to bring it up to date by the addition of information and techniques developed since the course was written," Mr. Veeck, chairman of the education committee reported. "It was decided that, rather than to attempt a revision of the course, the lesson material should be completely new," he added.

When it was decided to produce an entirely new course, the job of selecting authors and assigning subject matter was done by the education committee. The group was of the opinion that the best qualified men in the industry should be enlisted in the job of producing the course. It was believed, also, that the combined efforts of a group of men would be productive of a more desirable correspondence course, than if it were the work of one man.

In the proposed revision, the committee retained the organizational or structural outline of the original correspondence course, as prepared by the late Mr. Miller. The new course is composed of four units of 12 lessons each.

There was considerable change made within the framework, however, to include topics not included in the original course. The content of the course was agreed upon by the education committee. The subject titles were then assigned to various members of the committee and they, in turn, suggested names of the men they believed best qualified by experience and training to write the different chapters or lessons—48 lessons in all.

The education committee recommended that the identity of the author of each of the 48 lessons or chapters not be disclosed, reasoning that it should be the common and joint effort of the group, rather than of individuals within the group. For that reason, the title page of each

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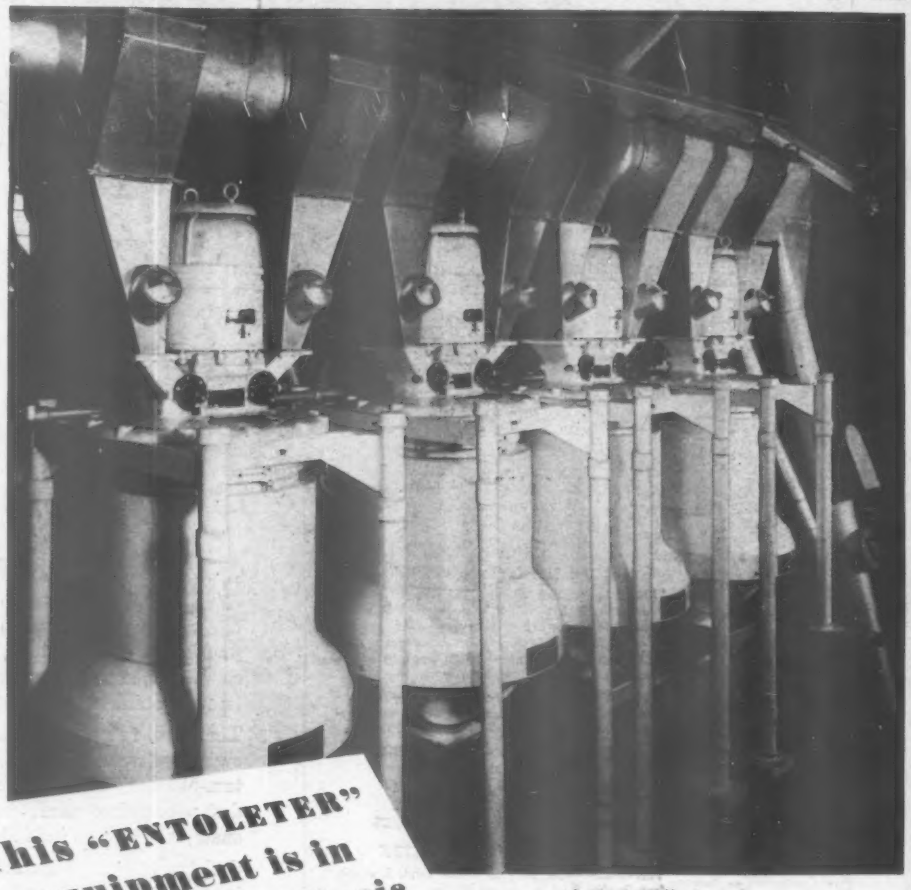

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During one of its meetings in Minneapolis, the education committee obtained the advice of F. L. Hansen, professor of education and head of the correspondence study department, division of extension, University of Minnesota. As the lessons were originally prepared, each lesson included a list of 10 "essay type" examination questions.

Mr. Hansen said that educators have found, by conducting many research studies, that the true-false and multiple choice type of examination will show as well as an essay type examination just how much or how little a student knows about the subject. Ease and speed of grading the examination sheets is the big advantage with a combination true-false and multiple choice examination. So the education committee decided to have this type of examination sheet prepared for each of the 48 lessons in the course. Donald S. Eber, executive secretary of the AOM, expressed his whole-hearted approval of the adoption of the true-false and multiple choice type of examination. He told the committee that grading the essay type examinations submitted by students was a time-consuming job.

The new type questions for the course were prepared by John M. MacKenzie in charge of the flour mill engineering course at the University of Minnesota; and by Eugene P. Farrell and Arlin B. Ward of the department of milling industry, Kansas State College.

Mr. Eber, in addition to serving as executive secretary of the AOM, also is director of its education department in that he supervises the keeping of records on the students and grades all of the examination sheets. The association is fortunate in having Mr. Eber in this position, for prior to becoming AOM secretary, he was superintendent of the Centennial Milling Co. plant at Spokane, Wash., and was a miller of recognized ability. In his work of grading the papers, Mr. Eber often writes individual letters to the students whom he believes are in need of further explanation on certain technical points. This added work on Mr. Ebert's part is appreciated by the students.

Training in Fundamentals

Unit No. 1 of the new correspondence course is devoted to fundamentals which, it is intended, will supply a basis for the remaining three units. In the preparation of the lesson material, authors were instructed to assume that those who would enroll in the course would possess at least a high school level of formal training.

Following are titles of the 12 lessons or chapters making up Unit No. 1:

1—History and Development of the Milling Industry.
2—Mathematics Useful to the Operative Miller.
3—Some Applications of Physics to Milling.
4—Engineering Drawing.
5—Mechanics
6—Uses of Air in Milling
7—Power
8—Power Transmission.
9—Grain Cleaning.
10—Milling Equipment.
11—Physical Characteristics of Wheat.
12—Other Products of Wheat.

Unit No. 2 of the course is devoted to discussions on grain standards and types, and the cleaning and preparation of wheat for milling, including tempering. The titles of the 12 lessons making up Unit No. 2 are:

1—Hard Red Winter Wheat.
2—Hard Red Spring Wheat.
3—Soft Red Winter Wheat and White Wheats.
4—Grain Movement and Unloading.
5—Preliminary Grain Cleaning and Binning.
6—Binning and Storage.
7—Mixing.
8—Dry Cleaning (Part I).
9—Dry Cleaning (Part II).
10—Wheat Washing.
11—Tempering and Conditioning (Part I).
12—Tempering and Conditioning (Part II).

Technology in Unit No. 3

"The Milling Process" is the title of Unit No. 3 of the course, and it is in this unit that the student first encounters lesson material having to do with the reduction of wheat to flour and its by-products.

The titles of the separate lessons are indicative of the subject matter contained:

1—Introduction to the Milling Process.
2—The Break System.
3—The Sizings and Middlings Streams of the Mill.
4—Purification of Middlings.
5—The Reduction System.
6—Flour Bolting and Analysis.
7—Tail End Streams.
8—Mill By-Products.
9—Flour Finishing.
10—Glossary of Milling Terms.
11—Flow Sheets.
12—Flow Sheet Design.

The fourth and final unit of the course is devoted to discussions of subject matter related to milling—information which the miller or mill superintendent finds useful in his job. The separate lessons are as follows:

1—Bulk Storage of Flour.
2—Cereal Chemistry for Millers.
3—The Baking Test.
4—Packaging and Materials Han-

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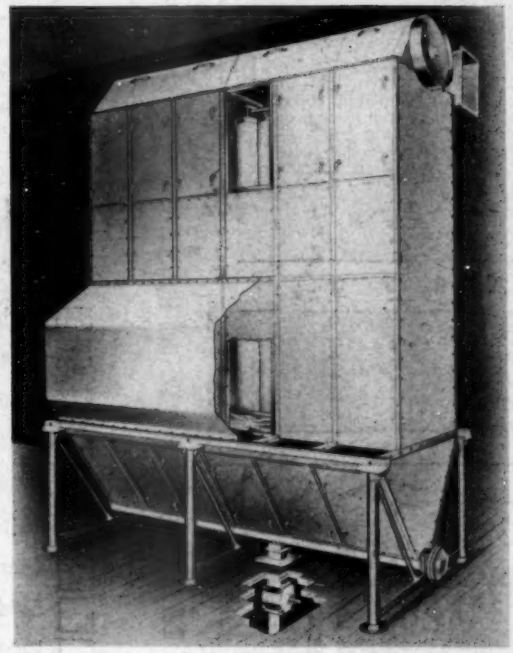

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6—Flour Mill Engineering.

7—A Summary of Freight Rates and Transit Privileges.

8—Grain Marketing.

9—Personnel Management.

10—Production Planning and Control.

11—Accounting for Flour Mill Operations.

12—Mill Organization and Management.

Editorial Committee Supervision

Actual production of the new course was under the supervision of an editorial subcommittee, headed by Paul L. Dittemore, technical editor of The Northwestern Miller, Minneapolis. Other members of this committee included W. W. Tholstrup, Wallace & Tiernan Co., Inc., Minneapolis; Prof. John M. MacKenzie, University of Minnesota, Minneapolis; John P. Snyder, Jr., Pillsbury Mills, Inc., Minneapolis, and Gerard Elverum, General Mills, Inc., Minneapolis.

It was the duty of this group to edit the manuscripts as they were received from the various authors, obtain suitable illustrative material where pictures or drawings were required to supplement the text matter, and to supervise the printing of the material, including proof-reading of the stencils.

The course was produced by offset printing on 8½ in. by 11 in. sheets, printed on both sides and punched for a loose-leaf binder. The printing was done by Burgess Publishing Co., Minneapolis, specialist in this type of textbook publishing. Production of the course by the offset process on separate sheets will permit revision or correction of any specific page in the course at a low cost.

Each lesson of the course is received by the student in a separate envelope so that he can remove the sheets from the envelope and transfer them to a ring-binder note book.

The following men contributed to the preparation of the text material of the course:

J. E. Anderson, Igleheart Bros. Division, General Foods Corp., Evansville, Ind.

Grant B. Astleford, Russell-Miller Milling Co., Minneapolis, Minn.

Frederick M. Atkinson, Atkinson Milling Co., Minneapolis, Minn.

Charley H. Broaded, Fisher Flouring Mills Co., Seattle, Wash.

Paul L. Dittemore, Miller Publishing Co., Minneapolis.

Frederic T. Dines, formerly with the Tex-O-Kan Flour Mills Co., Amarillo, Texas, and now with the Dines Grain Co., McClure, Texas.

Stanley Dybevick, International Milling Co., Minneapolis, Minn.

Eugene P. Farrell, Kansas State College, Manhattan, Kansas.

R. O. Fletcher, Pacific Northwest

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Wayne Fuller, Fisher Flouring Mills Co., Seattle.

A. D. Hyde, General Mills, Inc., Minneapolis.

Warren F. Keller, formerly with the Harvest Queen Mill & Elevator Co., Plainview, Texas, and now with Sterwin Chemicals, Inc., Kansas City.

H. R. Lathrope, Purdue University, La Fayette, Ind.

C. A. Lang, Russell-Miller Milling Co., Minneapolis.

Clifford MacIver, Archer-Daniels-Midland Co., Minneapolis.

John M. MacKenzie, University of Minnesota, Minneapolis.

Robert N. McCaull, Pillsbury Mills, Inc., Minneapolis.

Frank McCormick, Kansas State College, Manhattan, Kansas.

C. Dean McNeal, Pillsbury Mills, Inc., Minneapolis.

Lyle C. Mertz, General Mills, Inc., Buffalo, N.Y.

Max Milner, Kansas State College, Manhattan, Kansas.

Allan Q. Moore, Pillsbury Mills, Inc., Minneapolis.

Creighton B. Morrison, J. F. Imbs Milling Co., Belleville, Ill.

James H. Myers, Pillsbury Mills, Inc., Minneapolis.

Kenneth D. Nordstrom, General Mills, Inc., Minneapolis.

Royce O. Pence, Kansas State College, Manhattan, Kansas.

Dewey Robbins, Fisher Flouring Mills Co., Seattle.

Tibor A. Rozsa, Pillsbury Mills, Inc., Minneapolis.

George L. Smutny, formerly with the Allis-Chalmers Mfg. Co., and now with the Entoleter Division, Safety Car Heating & Lighting Co., Inc., New Haven, Conn.

The late C. O. Spencer, General Mills, Inc., Buffalo.

Frederick D. Schmalz, King Midas Flour Mills, Minneapolis.

W. W. Tholstrup, Wallace & Tiernan Co., Inc., Minneapolis.

George B. Wagner, Pillsbury Mills, Inc., Minneapolis.

Arlin B. Ward, Kansas State College, Manhattan, Kansas.

Llewelyn F. Wing, Fisher Flouring Mills Co., Seattle, Wash.

Joe Nate Wood, Kansas State College, Manhattan, Kansas.

C. R. Veeck, Eagle Roller Mill Co., New Ulm, Minn.

John P. Snyder, Jr., Pillsbury Mills, Inc., Minneapolis.

I.C.S. Sought Milling Course

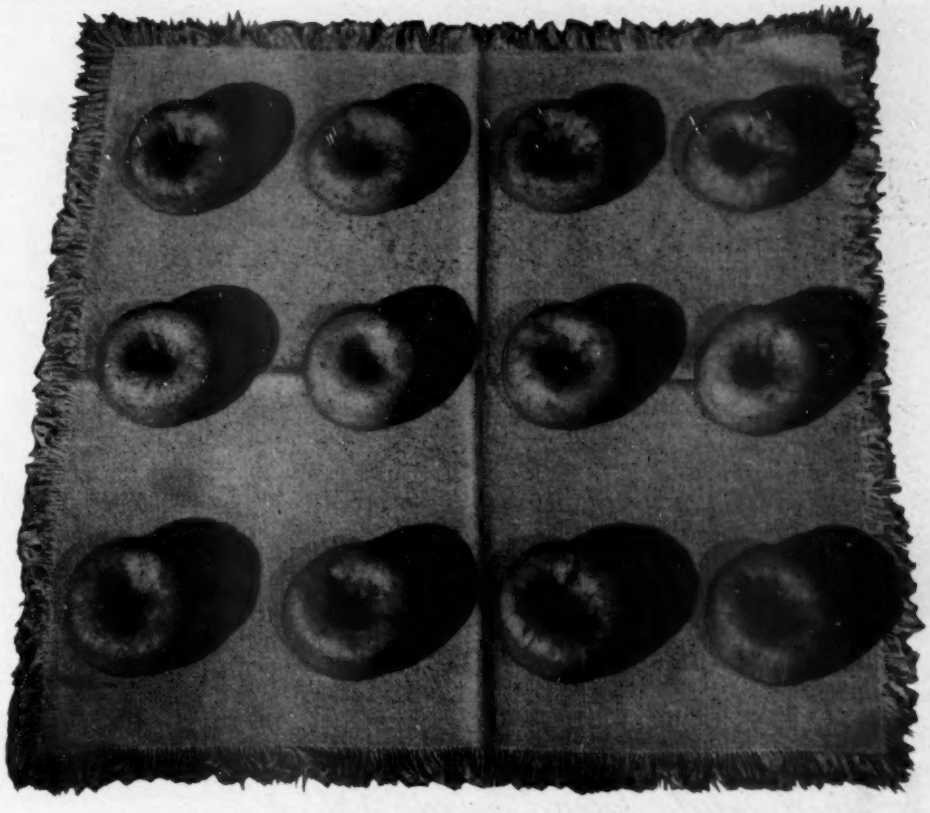
During the time that the course was in process of being prepared, the Association of Operative Millers was approached by representatives of the International Correspondence Schools, Scranton, Pa. The internationally recognized correspondence school made the AOM officials an offer to take over the course, supplementing the material on milling technology with some of its already prepared courses in mathematics, physics, labor relations, etc. I.C.S. would, however, have found it necessary to charge a much higher fee for the course than would the AOM, and the education committee of the millers' organization turned the offer down on the grounds that the AOM was morally obligated to offer the course to the milling industry at the lowest fee possible as its contribution to the welfare of the industry. The education committee also felt that, by keeping the fee for the course as low as possible, it would be available to a larger number of millers.

In announcing its decision to retain the course, the education committee made it plain that it was not implying that the I.C.S. was not qualified to conduct the course, or that its proposed enrollment fee was out of line. It was recognized that the correspondence school would necessarily have to charge a higher fee because it would have to pay its authors for preparation of the text material and defray other expenses. The education committee did, in fact, feel that the I.C.S. offer was an indirect compliment to the quality of the course in flour milling and to the AOM.

Millers who complete the course—and there will be scores in the years ahead—will feel that they earned the certificates awarded by the AOM for satisfactory completion. The course is no "push-over" or "snap" course which can be completed merely by sitting down and filling out examination blanks. It contains a wealth of information written by millers to be useful to other millers. The lessons require study. In return for the studying required, millers who enroll will be better qualified for their jobs after having completed the course.

Applications for enrollment, requests for additional information, etc., should be mailed directly to Donald S. Eber, executive secretary of the AOM and director of the correspondence course, 639 Board of Trade Bldg., Kansas City 6, Mo.

Mr. Eber reports there are now 97 persons enrolled in the new correspondence course. None of the enrollees have completed the course because it has been available for a comparatively short time. He said there are 180 students still active in the course which the AOM took over four years ago and that the AOM has issued 84 correspondence course certificates in that time to students who completed it under AOM sponsorship.



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SERVING INDUSTRY...WHICH SERVES MANKIND

Electronics Eliminates Cause of Dust Explosions

By R. H. Black
Allis-Chalmers Mfg. Co.

NOT a single dust explosion of any kind during an entire year of operation! This encouraging and enviable record was achieved by the Independent Mfg. Co. of Philadelphia, Pa., manufacturer of fertilizer and poultry feed. The significant achievement is attributed to the installation of an electronic metal detector for preventing entry of hot stray metal into highly combustible shafts.

Prior to the change to electronic equipment, Independent, like other milling concerns, had an annual average of two major explosions and numerous flashes. These, and the consequent shutdowns to rewind motors, electrical rewiring, replacement of conduits, and other repairs and replacements in addition to resultant production losses brought the company to the verge of discontinuing its poultry feed production unless some means was found of preventing flashes caused by undetected hot metal.

Other Obstacles Involved

Although the direct costs of explosions were prohibitive to profitable operation of the mill, several incidental problems were created. For one, employees were in constant fear of explosions. The mental strain reduced their efficiency and productive capacity because loss of life and limb or disfigurement were always a possibility.

Prior to installation and operation of the electronic metal detector, the company's insurance firm had been considering raising the rate after its recommended escape hatches and chemical sprinklers were found to be useless in preventing flashes. The Independent firm felt that these measures could be used to minimize damage only after an explosion had occurred.

Installation of the electronic metal detector and its successful operation put an end to the fears of employees and the insurance company has abandoned its proposed premium raise.

Stray Metal Dangerous

The Independent Mfg. Co. buys and processes waste meats, shop fats and tankage which is dehydrated into meal. Bone-dry materials are carried by bucket conveyors up a two-story shaft, fed through magnetic rolls and over a screen. Material which passes through the screen is conveyed to the shipping department, while the coarser particles are dropped down a shaft to a bar-cage grinder which consists of two cages spaced about two inches apart and turning in opposite directions at a combined relative speed of approximately 2,300 r.p.m.

Mechanized processing of products from which these wastes come, and subsequent handling usually contaminate them with metallic scraps. In addition to being a source of damage to milling and grinding equipment, scrap metal constitutes an almost inevitable cause of explosions if it is permitted to enter highly combustible shafts.

Pieces of hard metal, such as iron, steel and stainless steel a quarter of an inch or more in diameter, are actually beaten to white heat by the bar-cage grinder. When these pieces of white hot metal pass through the grinder and into the highly sensitive shafts an explosion is likely to occur. It was this inability to eliminate metal contaminations completely from the meal that led the company to consider closing its poultry feed production.

In spite of the use of magnetic rolls for metal detection, large pieces of metal, often steel, had passed through the grinder. This danger was further intensified by the wider use of stainless steel in the food industry because such particles in the waste products are not picked out by the magnetic rolls.

Electronic Detector Solves Problem

Because of its sensitivity to magnetic and nonmagnetic, ferrous and non-ferrous metals in nonmagnetic materials, either packaged or bulk, Independent decided to install the electronic metal detector. Although normally the electronic metal detector is employed to detect stray metal in products either to prevent damage to processing equipment, or to produce a metal free product, this unit was installed primarily to reduce the danger of explosion.

It was placed just ahead of the bar-cage grinder so that tramp metal could be spotted and removed before it entered. If metal is present the conveyor belt is stopped and an employee, working in conjunction with the detector, removes the objectionable metal before resuming operation.

Although reasonably reliable automatic rejection of the scrap metal is possible, the employees prefer not

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to trust automatic operation. The company is willing to pay an employee to keep constant watch at the metal detector to remove foreign metal manually before he pushes "start" button to resume operation.

Both the magnetic rolls and the electronic detector are being used at present. The older process still removes magnetic metals, but the electronic device now removes from 8 to 10 lb. of scrap metals per day, mostly non-magnetic such as stainless steel, bronze, brass, etc., which are not removed by the magnetic rolls and which could provide the spark to set off the explosive atmosphere in the mill if they were allowed to enter the shaft.

The electronic metal detector is a safeguard designed to protect nonmetallic products from tramp metal. It is especially suitable for operations using valuable tools, dies, molds, engraved rolls, and calendars. A piece of undetected metal brought into contact with any of these pieces of equipment may cause sufficient damage so that the entire piece would have to be scrapped, or would require extended shutdown until necessary repairs could be made. Many units are employed by food manufacturers, also, to inspect finished products for the presence of tramp metals.

The detecting device consists of two box-like compartments separated by non-conducting spacer blocks to form an inspection aperture which can be used vertically, horizontally, or on an inclined plane for inspecting conveyed, falling, flowing or packaged goods.

The lower head contains two oscillator or field coils which, when energized, transmit high frequency, electro-magnetic waves through the inspection aperture. These waves are equal in phase but opposite in direction so that the voltage induced in the detector coil will be zero.

When metal is introduced into the inspection aperture, this normally balanced field becomes unbalanced and a voltage is induced in the detector coil housed in the upper compartment. This voltage is amplified and fed to a detector tube which triggers a thyratron tube, which activates control or rejects relays operating externally signaling and stop devices. Normal operation may be restored manually by push-button, or automatically through time-delay relays.

The electronic metal detector may be used on conveyors at speeds ranging from 15 to 600 feet per minute with full sensitivity to detect tramp metal particles as small as .047 in., regardless of how deeply they may be imbedded in the product. It is simple to operate and requires very little maintenance.

Detecting compartments are housed in a heavy-gauge aluminum enclosure, so there is no danger to operating personnel from exposed electrical connections. The entire assembly is shock-mounted for protection against building and conveyor vibration.

The completely self-contained unit needs only to be plugged into an electrical outlet for operation. Units are available in standard aperture heights of 4, 7 and 12 in., and special sizes can be built for applications where standard units cannot be used.

Because of its successful operation at Independent, the unit is considered an essential part of the mill by the owners as well as the employees. Aside from the direct contributions to trouble-free operation of the mill and elimination of heavy expenses due to explosions, the electronic metal detector has removed the psychological barrier which disturbed employees and had reduced their efficiency.

——BREAD IS THE STAFF OF LIFE——

MILL SCHOOL HEADS ON IIMT MEETING PROGRAM

CHICAGO—Members of the International Institute of Milling Technology will hear reports from the heads of the two milling schools in the U.S. when the organization holds its annual meeting May 15 in connection with the convention of the Association of Operative Millers.

Dr. J. A. Shellenberger, head of the department of milling industry, Kansas State College, Manhattan, and Prof. John M. MacKenzie, head of the flour mill engineering course in the department of mechanical engineering, University of Minnesota, Minneapolis, will be the principal speakers on the program.

There will also be an election of officers and other business transactions during the meeting. The business meeting will be followed by an entertainment program.

Esli A. Marsh, St. Regis Sales Corp., Oswego, N.Y., is president of the IIMT. He will preside at the meeting.

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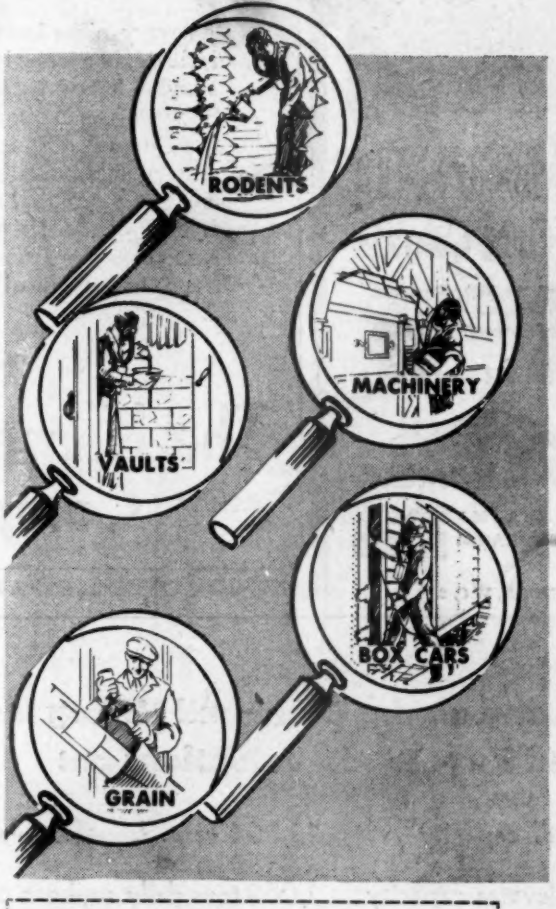

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Evaluation of Commercial Flours

★ ★ ★

The evaluation of commercial flours is not such a clear-cut issue because flours are manufactured for a number of different purposes, and consequently call for different methods of assessment. The bulk of the flour produced is, however, bakers flour and we will, therefore, give this first consideration. It would not suffice if a report upon a flour were to follow a wheat report and indicate only the inherent protein characteristics of the flour. A commercial flour is in its final form, i.e., it represents a purposefully chosen blend of wheats and has been judiciously treated with improvers, and the miller and baker are now concerned with the properties of its protein when it is subjected to the influence of yeast fermentation embodying the effect of enzyme action and of chemical improvers. Some mechanical dough tests are performed on fermenting doughs, but the miller and baker are interested to only a minor degree in a numerical measure of individual physical properties of commercial flour; their prime concern is how the flour will behave when it is subjected to the test which it will have to meet if it is to prove commercially satisfactory, namely, a yeast baking test. Thus, although certain mechanical dough tests may prove useful, particularly in bakery control laboratories, as supplementary procedures, the final evaluation of commercial flour should be based upon a properly designed and controlled baking test.

It may be asked what is a properly designed baking test? As far as this country is concerned, it is a baking test performed by a skilled test baker on a fermentation system in common use commercially. In America, test baking has developed in another direction. There, the trend has been to evolve a rigorously standardized procedure based on the use of only 3½ oz. of flour, followed by a measurement of the volume of the "pup" loaf thus produced. In our eyes, this is a very artificial procedure, and it is not suitable for general application in Great Britain where, in the days of free choice of wheats, the flours vary greatly in strength and balance of protein characteristics.

Flours intended for purposes other than bread making may require a different approach, but which method of assessing the protein characteristics is the best will be governed by the purpose for which the flour is to be used. As an example, we can consider biscuit flours. These are made from weak wheats, such as English, but the biscuit manufacturer looks not only for weakness but a certain balance of dough properties. It is not very easy, and indeed not possible, to assess the relative values of biscuit flours by a baking test, because they are so far removed in nature from normal baking flours and their extreme weakness renders the detection of finer differences in balance of characteristics a doubtful matter. For biscuit flours, therefore, the best method of assessment is a mechanical dough test of the type suitable for wheat testing, i.e., one which permits individual physical properties to be measured on a numerical basis.

The foregoing discussion will have revealed that the critical baking test and the mechanical dough test permitting the independent assessment of different physical characteristics have their respective places in the evaluation of dough properties but they are not interchangeable. They yield different information and fulfill different purposes, and which is the more suitable for a particular test depends upon what it is hoped to learn from that test. For testing wheats and some non-bread flours, a suitable mechanical dough test is undoubtedly far more informative and helpful than a baking test, whereas for bread flours the reverse most certainly holds good.

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Pointers on Profitable Grinding and Mixing Operations

• • •

By Arthur Roberts

FEED dealers have often asked us about installing grain grinding and mixing equipment. From our experience with such installations, we find that the problem that all dealers face in connection with this investment is an adequate appraisal of territorial requirements.

We have known more than one dealer who has had difficulty with an installation because he purchased unsuitable machinery. He did not make a survey beforehand to find out whether the grain grinding and mixing equipment was applicable to his territory or a likely investment from the standpoint of profits for his business.

Selling grinding and mixing service differs from resale operations in a feed store. It has certain angles that the dealer should investigate before he invests in an installation. First, the dealer should find out something relating to the normal grain supply in his territory, the nature and amount of the livestock population.

He can get this information by contacting from 50 to 75 farmers in the territory. The calls may be brief

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and spotted equally along all principal roads from town to assure fair sampling. It is unwise to cover a distance more than 10 miles from town; sometimes 5 miles is ample because experience has shown that the majority of grinding jobs will not come from outlying sections farther away.

Getting Information

The dealer should experience no difficulty in getting information. He can get comments from the farmers interviewed about the wisdom of making an installation and find out how much grain and livestock there is in the territory, the size of the grain crop each farmer is raising, the equipment he may need and the outlook for grinding business.

In surveying a territory for grain grinding possibilities, the dealer who has an opportunity to draw trade from all sides is better off than the dealer who is blocked by certain factors from getting complete coverage. A river or toll charge between the farmer and the dealer's mill may keep farmers in one section away; another section may be devoted to non-grain crops, or it may be poor grain growing land or just plain range.

Heavy traffic may present an obstacle to farmers bringing grain to the mill. The dealer with grinding and mixing facilities on the outskirts of a town has the advantage here. The farmer likes to keep out of a congested city area. The dealer in a populated section must also consider that grinding noises and dust may be obnoxious to his neighbors, and there may be local ordinances against it, in which case he may be obliged to install dust-collecting equipment and sound-proof to minimize noise.

On the brighter side, grinding and mixing equipment is a business builder for sales of allied lines. Farmers bringing their grain into the mill are potential customers for poultry equipment, dairy supplies, animal medicines, etc.

Measure Profitability

However, this indirect advantage is not enough to make an installation profitable. The dealer should have a means of measuring the profitability of the equipment itself. This is a mathematical calculation. Based on a field survey indicating the equipment required, the dealer may decide that he will invest $3,000. With this figure as a base he can prepare a rough budget of operating expenses:

Depreciation—figured at 10% a year—a straight-line write-off on $3,000	$300
Labor	1,500
Power	400
Miscellaneous—repairs and overhead in the mixing department	200
Total estimated yearly expense	$2,400

The figures will vary with labor costs in the territory. The amount allotted in this estimate assumes that a man will work only part of his time on grinding. The power charge is based on an estimate which is about minimum and would apply to a 30-40 h.p. motor on a ton mixer.

If the dealer's estimate is $2,400, he must get this much sales volume to break even. If the grinding charge is 10¢ cwt. (this will vary with the territory), the dealer must get a minimum volume of $8 a day, based on 300 working days a year, to gross $2,400 and break even. What he earns in excess of this amount is profit. At 10¢ cwt., he must grind 24,000 cwt. yearly or 80 cwt. daily. If the average size job in his territory is 8 cwt., he must average 10 customers a day.

Determine Possibilities

The survey, if done properly, should give the dealer an idea of the amount of grain brought to town, whether it is sacked or in bulk and how often the farmers go to the mill. This information will tell the dealer how many customers he must get to break even. A survey will help him evaluate his chance of getting these customers. The volume per customer may be determined by finding out when making the survey how many bushels of grain each farmer grows and the number of cows, hogs, chickens and cattle customarily raised. The dealer can also determine by a survey the predominating price paid for grinding in the territory and whether the farmers are satisfied with the service.

If a dealer finds from a survey that an installation of grinding and mixing equipment will be profitable, he must then consider ways and means of serving his customers properly. The results of his survey will give him valuable information here. There is no standardization. Facilities differ with the location and the territory. He may find from a survey that he can use more than grinding and mixing equipment—a corn crusher, seed cleaner, driveway dump, truck hoist, etc. He may need a corn sheller. If his survey shows that there are many portable shellers in the territory, it may not be profitable to install this equipment. If there is little home shelling, feeders usually go to the mill for this service.

If feeders have been accustomed

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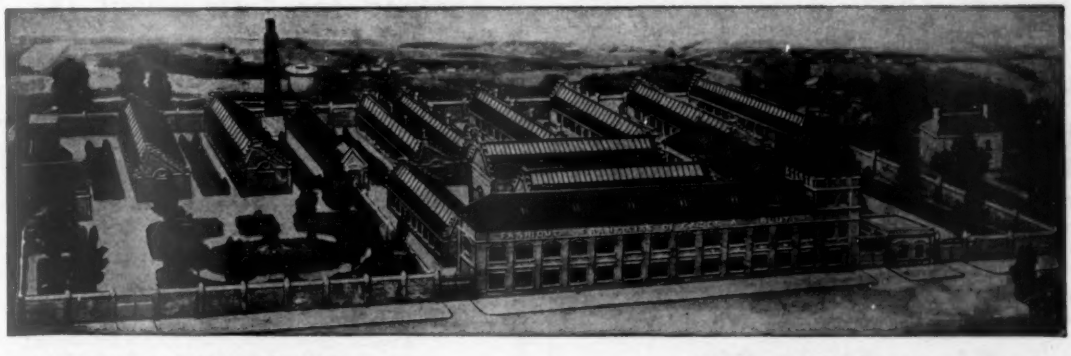

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to bringing their feed to the mill in bulk, the dealer can handle customers quickly and economically by installing a driveway dump or a truck hoist. The dealer who does not survey his territory properly is likely to find this business unprofitable. Too often the dealer who complains about the results he gets from his grinding and mixing department is not using equipment that fits all requirements. He does not provide those closely related services which the territory demands and the customers go to a one-stop milling station where they can get an all-round service suited to their needs and have the job done quickly.

Can Be Promoted

At the start, it may be slow going as it is in all new enterprises. The service can be promoted effectively and economically with direct-mail sent to old customers and new prospects. We know dealers who have built up a nice grinding business with postcard mailings plus phone calls to farmers during the hours they are likely to be home.

Profits depend largely upon volume. The grinding department costs money to run, and it costs money when it isn't running mainly because of the investment in the equipment and the overhead applicable to mill operations. In most instances, labor costs stop when the mill isn't working because a worker can be given something else to do. The dealer should keep his mill operating as close to capacity as possible, and this requires sales promotion. Too much unsold capacity means limited profits.

From our field experience, we find that many dealers take a "come and get it" attitude toward their grinding customers. They seldom push for business, even in cases where they promote resale items with vigor. If you aren't getting capacity in your feed mill, you are not promoting sales properly, there are not enough potential sales in the territory, or your equipment is too big, has not been properly sized to requirements, or you haven't got the right equipment. The dealer who has a high ratio of unsold capacity because his equipment isn't properly sized or it is inadequate is usually in this sorry condition because he did not survey the territory properly or he made no preliminary study whatsoever.

A grinding and mixing department, if properly installed, supervised and promoted, can be a profitable part of many establishments. But before the dealer makes the installation, he should survey his territory to appraise possibilities and then invest in the installation that will give his customers adequate service at prices prevalent in the territory.

If a dealer has been operating a mill without too much success, he should find the counsel given in this article helpful. Let him start now to survey his territory to find out what is wrong. We know a number of dealers who were in this position. After surveying the territory, they installed equipment more suitable to local needs and increased their milling profits substantially.

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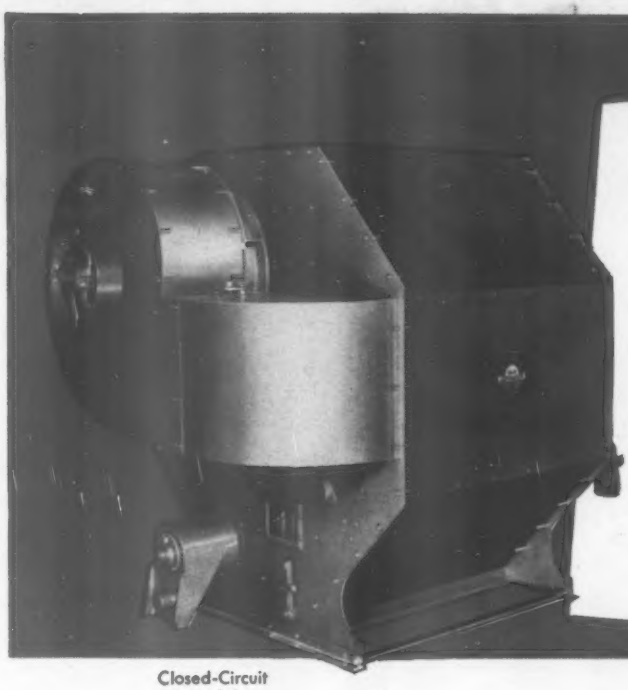

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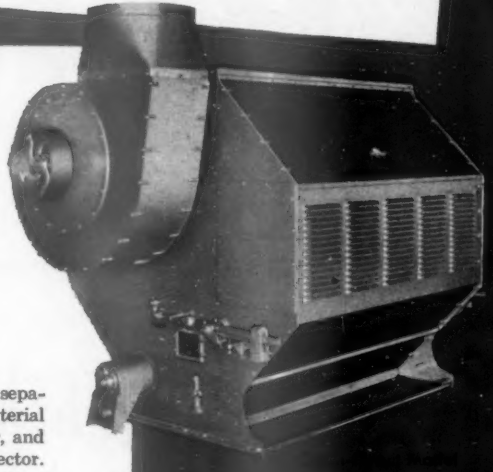

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